

Oct. 30, 1923.

1,472,505

R. F. TRIMBLE

METHOD OF MAKING ELECTRODES

Filed April 16, 1920

2 Sheets-Sheet 1

Fig. 1.

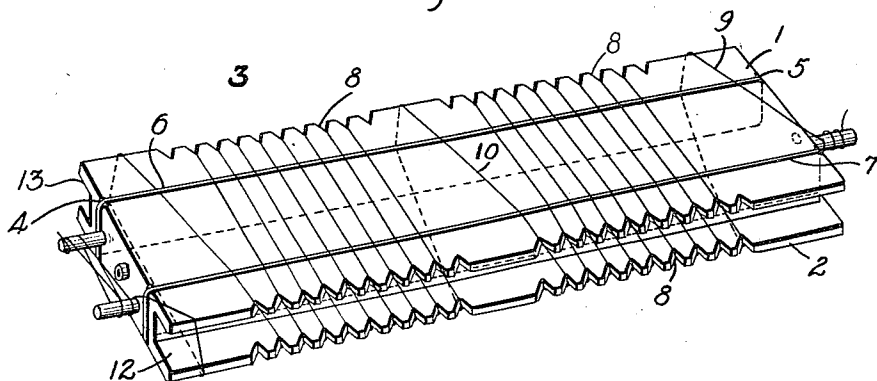


Fig. 2.

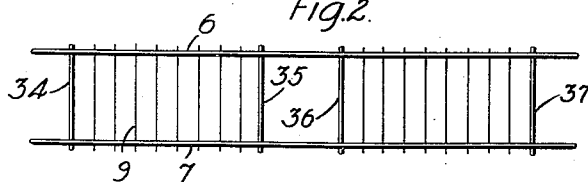


Fig. 3.

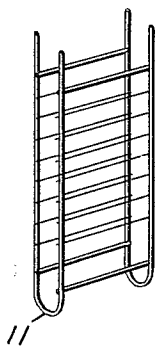


Fig. 4.

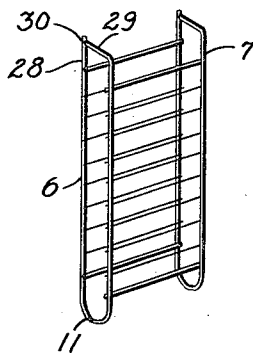
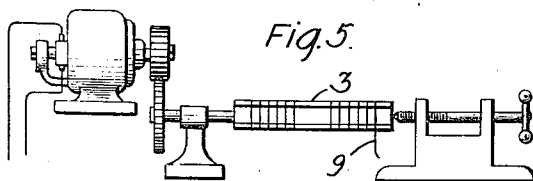


Fig. 5.



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2 Sheets-Sheet 2

Fig. 6.

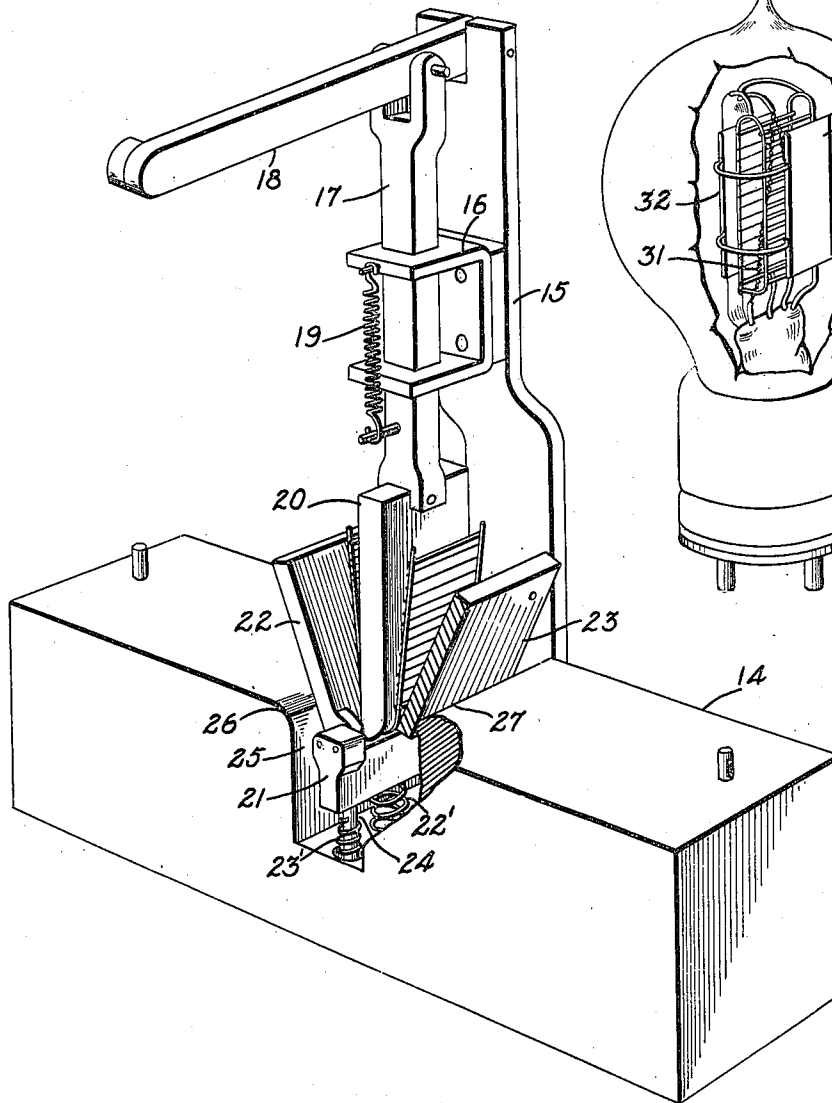
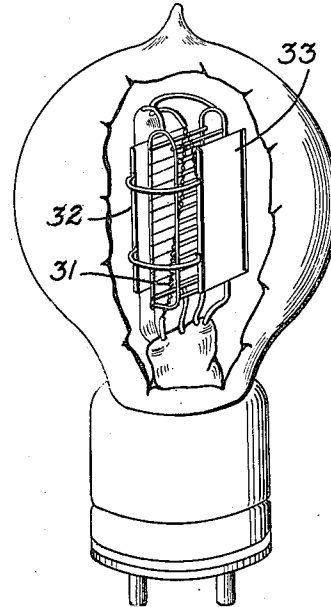


Fig. 7.



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UNITED STATES PATENT OFFICE.

RUSSELL F. TRIMBLE, OF ELIZABETH, NEW JERSEY, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

METHOD OF MAKING ELECTRODES.

Application filed April 16, 1920. Serial No. 374,418.

To all whom it may concern:

Be it known that I, RUSSELL F. TRIMBLE, a citizen of the United States, residing at Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Methods of Making Electrodes, of which the following is a full, clear, concise, and exact description.

The invention relates to electrode structures which may be employed in an electrical discharge device such as a thermionic device of the audion type.

One type of audion employs a filamentary cathode, a grid at each side of the cathode and a plate or anode surface adjacent each grid. The two grid electrodes, and the same is true of the two plate electrodes, are electrically connected together inside or outside of the evacuated container. A stronger and more compact arrangement of the double electrodes is provided according to the present invention, wherein the double electrode is provided in the form of a unitary structure. This has been applied to the manufacture of the grid or screen electrode which specifically is composed of two parallel U shaped side wires, parallel cross wires extending from one U to the other and at right angles thereto.

The feature of this invention resides in the manufacture of double electrodes. This is done by providing an extended electrode surface which is bent upon itself in such a fashion as to provide the desired number of electrode surfaces.

A jig is made use of in the manufacture of the grid electrode. This jig may be employed for making not only single grid electrodes, but it is particularly useful in the manufacture of a plurality of double grids, all of which may be made practically at the same time and in one continuous mechanical operation. On each of a plurality of flat jig faces are laid parallel wires which are to form the sides of the grid. The cross wires are formed by winding a wire across the side wires, the intersections being welded or otherwise fastened. The resulting composite structure is divided to form the required plurality of electrode surfaces. The grid made in accordance with the above method is described and claimed in application Serial No. 261,030, filed November 2,

1918, for electrodes and their construction, of which this is a division. The jig employed in the above process is described and claimed in application Serial No. 374,419, filed April 16, 1920, which is also a division of application Serial No. 261,030.

Referring to the drawings for further details of the invention, Fig. 1 discloses in perspective a jig that may be employed in the manufacture of the electrode.

Figs. 2, 3 and 4 illustrate a grid electrode in various stages of its manufacture.

Fig. 5 illustrates diagrammatically a lathe that may be employed for revolving the jig shown in Fig. 1.

Fig. 6 illustrates in perspective apparatus that may be employed for bending an electrode into the shape illustrated in Fig. 3.

Fig. 7 illustrates a vacuum tube device in which the electrode shown in Fig. 4 may be employed.

The top face 1 and the bottom face 2 of the jig 3, illustrated in Fig. 1, are constructed the same, the top face being provided with notches 4 and 5 that receive the longitudinal extending wire 6 which is to form one of the side wires in the grid. This wire 6 is continued across the face 2 as illustrated in dotted lines. A similar side wire 7 is also provided and is continued across both faces of the jig. The wires 6 and 7 may be held in the position shown by having their ends twisted or in any other suitable manner. Each edge of each face of the jig is provided with grooves 8 which are adapted to receive the wire 9 which is wound around the jig and across both faces thereof to provide the cross wires of the grid. The winding process may be performed by hand or preferably the jig is supported in a lathe such as conventionally represented in Fig. 5, in order that it may be rotated while the wire 9 is wound thereupon. It will be noted that the wire 9 in passing from the front grooved edge of the lower face to the front grooved edge of the upper face is offset, a similar offset being unnecessary at the other edge. This makes it possible for the wire 9 to cross always at right angles to the side wires 6.

After the wire 9 has been wound upon the side wires as shown, the wires where they intersect are suitably fastened together, for instance, by welding. That portion of the wire represented by 10 at the middle of the

jig is not welded to the cross wires, the vacant portion at the middle of the jig being provided in order that room may be had for forming the arch 11 which integrally connects the two grid surfaces as shown in Figs. 3 and 4. The reinforcing wires shown at 34, 35, 36 and 37 Fig. 2 may be cut to approximately the proper length, laid across the side wires 6 and 7 Fig. 1 and welded thereto, while the wires 6, 7, 34, 35, 36 and 37 are shown heavier than the cross wire 9, these may all be of the same size or the cross wires 9 may be larger than the other wires. After the intersections of the cross and side wires have been welded, a suitable cutting tool, such as a pair of scissors, may be passed along a groove 12 and a similar groove 13 at the other edge of the jig in order to cut the wire 9 along these grooves. The side wires 6 and 7 are also cut at the ends of the jig. This releases two double grid surfaces somewhat of the form shown in Fig. 2. After trimming the ends of the cross wires 9, which project beyond the side wires 6 and 7, the resulting electrode may be suitably bent into the shape shown in Fig. 3 and for this purpose the machine shown in Fig. 6 may be employed.

The bending machine shown in Fig. 6 comprises a base portion 14 from which rises a standard 15 which supports, by means of the guide 16, a reciprocating plunger 17, which may be operated by the handle 18. The plunger is normally urged to its uppermost position by means of the spring 19, which is fastened at its lower end to the plunger and at its upper end to a portion of the guide 16. The plunger is provided with a head 20, the shape of which conforms to the inside of the electrode shown in Fig. 3. The middle portion of the base 14 is recessed and houses a block 21, at each side of which is pivoted the plungers 22 and 23. The device 21 is normally urged to its uppermost position by means of the spring 22'. The block 21 is guided by the pin 24 and a similar pin at the other side of the block not shown. Surrounding the pin 24 is a spring 23', which serves to cushion the block 21 in its downward movement. When the block 21 is in its uppermost position, the head 20 being held at some distance above it, the flaps 22 and 23 each lie flat on the top faces of the base 14. After a flat extended electrode of the form shown in Fig. 2 has been trimmed it may be positioned upon the flat upper faces of the flaps 22 and 23. Upon depressing the handle 18, the head 20 forces the block 21 down into the groove 25, along the rounded edges 26 and 27 of which the flaps 22 and 23 slide until they are caused to assume vertical positions tightly wedged against the head 20. Upon releasing the handle 18 the head 20 is retracted and the grid which has been bent

to the form shown in Fig. 3 may be removed.

To further strengthen the grid structure the projecting end 28 of the side wire 6 may be welded to the adjacent projecting end 29 as shown at 30 in Fig. 4. The other two projecting ends of the side wire 7 may be similarly welded.

It will be apparent that the grid electrode shown in Fig. 4 is a rigid compact structure, the side wires of which are U-shaped, the cross wires extending from the leg of one U to the corresponding leg of the other U.

The electrode shown in Fig. 4 is particularly adapted to be employed as a double grid electrode in a device of the audion type as shown in Fig. 7, wherein the grid electrode has one surface located between the cathode 31 and the anode or plate 32 and the other grid surface extending between the cathode 31 and the other plate or anode 33.

What is claimed is:

1. The method of making an electrode having opposed surfaces which comprises forming an extended electrode surface and bending said extended surface to provide said opposed surfaces.

2. The method of making an electrode having opposed parallel surfaces, which comprises forming an extended electrode surface and bending said extended surface to provide said opposed parallel surfaces.

3. The method of making an electrode having parallel surfaces which comprises forming an extended plane electrode surface and bending said electrode surface to provide said parallel surfaces.

4. The method of making a grid electrode which comprises crossing wires, welding them at their intersections to provide an extended planary surface, bending said surface to provide a pair of parallel members, and joining together the ends of said surface.

5. The method of making a grid electrode which comprises crossing wires, welding them at their intersections to provide an extended planary surface, and bending said surface to provide parallel electrode surfaces.

6. The method of making a grid which comprises providing a plurality of spaced longitudinally extending wires, winding wire across said longitudinally extending wires to form a pair of opposed planary surfaces, and welding the intersections of said wires.

7. The method of making a grid which comprises providing a plurality of sets of parallel wires, winding wire around the members of said sets, welding the intersections, and severing said enclosing wire between said sets of parallel wires.

8. The method of making a grid which comprises providing a plurality of sets of parallel wires, winding wire around the members of said sets, welding the intersections, severing said enclosing wire between said sets of parallel wires, and bending each set of parallel wires to provide parallel surfaces.

10 9. The method of making a grid which comprises positioning a longitudinally extending wire on a jig, revolving said jig and thereby winding a wire around said longitudinally extending wire, and welding the intersections.

15 10. The method of making a plurality of grids which comprises winding a wire helically about a plurality of sets of longitudinally extending wires, welding the intersections, and separating said sets.

11. The method of making a plurality of 20 grid electrode surfaces which comprises winding a wire across a plurality of side wires, each of which is at least double the length of one grid surface, welding the intersections, and bending the extended electrode surface thus formed to provide opposed 25 grid surfaces.

12. The method of making a plurality of grid electrode surfaces which comprises winding a wire helically around a plurality 30 of sets of side wires each of which is at least double the length of one grid surface, welding the intersections, separating said sets, and bending each set to provide 35 opposed parallel planary surfaces.

In witness where I hereunto subscribe my name this 14th day of April, A. D. 1920.

RUSSELL F. TRIMBLE.